GREATER CROSSBOW OIL AND GAS EXPLORATION AND DEVELOPMENT PROJECT DRAFT PLAN OF DEVELOPMENT Revised September 2015

Prepared for Bureau of Land Management
Buffalo Field Office

Submitted by EOG Resources, Inc.

1 INTRODUCTION

In 2013, EOG Resources, Inc. (EOG) approached the Bureau of Land Management (BLM) Buffalo Field Office about preparing an Environmental Impact Statement (EIS) for proposed oil and gas exploration and development within the Greater Crossbow Area (**Figure 1**) in Campbell and Converse Counties, Wyoming (hereinafter referred to as the Greater Crossbow Project Area, Project Area.

EOG is proposing an innovative "spine and rib" approach that would maximize the use of multi-well pads (i.e., the ribs) that are strategically placed along well-planned, primary corridor systems that would include pipelines for oil, natural gas, condensate, fresh water, produced water, as well as utility lines (i.e., the spines). The spine and rib design of the Greater Crossbow Plan of Development (PoD) (hereinafter referred to as the Greater Crossbow PoD or Greater Crossbow Project) is intended to reduce surface disturbance, habitat fragmentation, truck traffic, and air emissions compared to that of a traditional oil and gas field development project. EOG's proposed design would result in reduced impacts for multiple, potentially affected resources.

Key features of the Greater Crossbow PoD include the following:

- Development of an average of approximately 150 oil and natural gas wells per year over 10 years[1], for 1,500 total oil and natural gas wells.
- Construction of up to 100 optimized development well pads (ODP).
- Two ODPs per section.
    - An individual ODP could host between 1 and 22 wells. For analysis purposes it is assumed that each ODP would host an average of 15 wells.
- Drilling of numerous formations per pad.
- A primary corridor system to include pipelines for oil, gas, condensate, fresh water, and produced water, as well as utility lines, which would substantially reduce truck traffic.

[1] Drilling is planned over a 10-year period; however, market conditions would dictate the length of the drilling phase and the number of wells drilled per year.

- Phased electrification of production facilities to reduce air emissions.

1.1 PROJECT LOCATION AND BACKGROUND

Project Location

The Greater Crossbow Project Area is located in the southern extent of the Powder River Basin (PRB) and includes portions of southern Campbell and northern Converse counties in northeast Wyoming. The Project Area is between Wright and Bill, WY, and encompasses all or portions of ten townships including T42N:R73W - T42N:R71W, T41N:R73W – T41N:R71W, T40N:R72W – T40N:R71W, and T39N:R72W.

Elevations within the Greater Crossbow Project Area range from approximately 4,500 to 5,500 feet above mean sea level. The Project Area falls within the Powder River Basin and Great Plains physiographic provinces and is located within the Antelope Creek drainage system. The area has historically been and is currently used for livestock grazing, oil and gas development, coal mining, wildlife habitat, and recreation. This area provides summer and fall grazing for cattle, sheep, and horses.

1.2 SURFACE AND MINERAL OWNERSHIP

The approximately 106,987 surface acres of the Project Area includes about 93,140 acres of privately owned lands (87% of the PA), 8,192 acres (8% of the PA) of State lands administered by the State of Wyoming, and 5,655 acres (5% of the PA) of federal lands managed by the U.S. Forest Service (USFS) Thunder Basin National Grasslands (TBNG). Surface and mineral ownership is summarized in **Table 1**. Of note, there is no BLM-administered surface within the Project Area.

TABLE 1

SURFACE AND MINERAL OWNERSHIP IN THE GREATER CROSSBOW PROJECT AREA

SURFACE OWNERSHIP (ACRES)	
Private	93,140 (87%)
State	8,192 (8%)
Thunder Basin National Grasslands	5,655 (5%)
Total Surface Acreage	**106,987**
MINERAL OWNERSHIP*	
Private	30,763 (29%)
State	8,020 (8%)
Federal (BLM and USFS)	68,203 (64%)
Total Mineral Acreage	**106,987**

*****Mineral ownership acreage generated by EOG due to the confidential nature of mineral ownership. Mineral ownership calculations are also based on spatial analysis rather than land records.

1.3 EXISTING DEVELOPMENT

In 2013, the majority of oil wells spudded in Wyoming occurred within the PRB. While oil production in Wyoming has been growing as a result of new drilling technologies and shale plays (e.g., the Niobrara), natural gas production has been in steady decline since 2009.

The three primary producing plays within the PRB in Wyoming are the Frontier Formation, Cody Shale, and Mesaverde Formation.

Geographic Information System (GIS) data were used to identify the number of existing "active or producing" wells in the Project Area from the WOGCC database. Existing "active or producing" wells included those categorized as:

- "Drilling or Drilled Permit" (DP)
- "Monitor Well" (MW)
- "Producing Gas Well" (PG)
- "Producing Oil Well" (PO)
- "Pumping Rods" (PR)
- "Pumping Submersible" (PS)
- "Well Spudded" (SP)

Wells in the Project Area categorized by the WOGCC database as "Notice of Intent to Abandon" (NI), "Shut-in" (SI), or "Subsequent Report of Abandonment" (SR) were dismissed from inclusion because the BLM assumes reclamation of these wells was 100% successful. No "Temporarily Abandoned" (TA) wells were found to overlap the Project Area.

As of May 6, 2015, the WOGCC database identified 260 wells as being existing “active or producing” wells. Table 2 summarizes the type and status of these wells within the Project Area. As this table shows, the majority of existing “active or producing” wells in the Project Area were identified as CBNG wells and horizontal oil and gas wells, with fewer numbers of vertical oil and gas wells, monitoring wells, and unknown wells. Existing “active or producing” wells in the Project Area included various combinations of federal, state, and fee ownership of minerals and surface estate, with the most common being fee surface with federal minerals and state surface with state minerals (WOGCC 2015).

As of May 6, 2015, the WOGCC database contained approximately 462 records for existing and permitted wells in the Project Area. Of these records, 13 wells had NI, 38 wells were SI, and 63 wells were SR. These wells were excluded from the existing condition because as previously stated, the BLM assumes reclamation of such wells has been 100% successful. Additionally, 93 wells were permitted, but not yet constructed.

The WOGCC database was also cross-referenced with survey plats for EOG’s (proposed) 2015 Interim Environmental Assessment (EA). These survey plats were used to identify existing wells in the Project Area that were not included in the WOGCC database.

TABLE 2
EXISTING OIL AND GAS WELL TYPE
WITHIN THE GREATER CROSSBOW PROJECT AREA

WELL TYPE	NUMBER OF WELLS
Horizontal Oil and Gas Well	108
Vertical Oil and Gas Well	8
CBNG Well	138
Disposal Well	0
Injection Well	0
Other Well	0
Monitoring Well	1
Unknown Well	5
Well Total	**260**

Source: Uintah Engineering 2014, Uintah Engineering 2015a-r, and WOGCC 2015.

Note: Well numbers are largely based on available WOGCC well data for the Project Area, with NI, SI, and SR wells removed. Additionally, no TA wells were found to overlap the Project Area.

1.4 INTERIM DEVELOPMENT

EOG is proposing an interim drilling program that will allow wells to be drilled during the preparation of the EIS. Interim drilling will include wells for which APDs have already been secured, wells for which approved APDs are pending, and new wells for which APDs will be submitted. The BLM will prepare site-specific NEPA analyses to support EOG's interim drilling plans. Interim drilling will help EOG to define the reservoir geology in the Greater Crossbow Project Area, and will consequently allow them to refine ODP locations.

1.5 EOG RESOURCES, INC.

EOG is one of the largest independent (non-integrated) crude oil and natural gas companies in the United States with proved reserves in the United States, Canada, Trinidad, the United Kingdom, and China. As of December 31, 2013, EOG's total estimated net proved reserves were 2,119 million barrels of oil equivalent (MMBoe). Approximately 94 percent of these reserves were located in the United States. EOG's total company production in 2013 was 186.2 MMBoe. Approximately 88 percent of the company's 2013 total production was in the United States and Canada.

1.6 PURPOSE AND NEED

The purpose of the project is to allow EOG to develop, produce, and market oil, gas condensate, and associated hydrocarbon products, pursuant to their rights and obligations under existing oil and gas leases issued by the BLM. The need for exploration and development of oil and gas resources is established by the BLM's responsibility under the Mineral Leasing Act of 1920 (30 United States Code [USC] 188 et seq.), as amended, to promote the mining of oil and gas on the public domain. Deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the Mineral Leasing Act. The BLM oil and gas leasing program encourages development of domestic oil and gas reserves, consistent with the BLM's multiple-use mission. The oil and gas resources produced from the Greater Crossbow project are needed to meet national domestic energy demand.

2 PLAN OF DEVELOPMENT

The following sections describe EOG's PoD for the Greater Crossbow Project Area. As noted in several sections of the PoD, EOG has made a good faith, preliminary attempt to identify conceptual locations for most of the proposed ODPs. Site-specific locations would be developed following the Record of Decision (ROD) for the EIS and in coordination with the private surface landowners and relevant agency stakeholders.

2.1 TARGET FORMATIONS AND SUBSURFACE SPACING

The Greater Crossbow Project includes both exploration and field development in that during Phase I of the project exploratory wells would be drilled to define the reservoir geology. Phase II development wells would be drilled where the reservoir has been defined. EOG is currently focusing on exploration of the Parkman, Turner, Mowry, Niobrara, and Muddy Formations; however, other potential geologic formations may also be identified as the exploratory wells are drilled. While this phased approach would be utilized as feasible, the exploratory nature of a portion of the drilling makes it difficult to precisely predict the drilling plan.

Subsurface well spacing is largely a function of reservoir geometry, i.e., the area of the producing formation that can be effectively and economically drained of oil and gas resources by a single wellbore. Sub-surface spacing for the Greater Crossbow Project would be formation-specific and would depend on the results of exploratory drilling.

2.2 PROPOSED WELL COUNT

As previously stated, EOG is proposing to drill up to 1,500 oil and natural gas wells at an average rate of approximately 150 wells per year. However, fewer wells may be drilled for the following reasons:

- Unforeseen variations in reservoir characteristics may result in re-evaluation of well spacing in some parts of the Project Area.
- Successful use of new technologies may allow production to be maintained at the projected levels but with the use of fewer wellbores.
- Economic factors (such as commodity prices) may affect EOG's ability to drill wells.

- Lease stipulations may prevent drilling a well in some areas.

2.3 PRE-CONSTRUCTION ACTIVITIES

Prior to surface disturbing activities, EOG would complete the following activities:

- Contact surface owners in accordance with the Wyoming Surface Entry Act;
- Perform biological, cultural resource, paleontological, and/or other surveys, as required by the appropriate Surface Management Agency (SMA) and agreed upon by the private surface owner.
- Stake and survey each surface location, access road, and pipeline corridor;
- Submit Notice(s) of Staking (NOS), APD, and USFS surface use authorization (SUA) or surface use permit (SUP) or State of Wyoming (WY) temporary use permit (TUP) as applicable, to the appropriate SMA;
- Participate in onsite evaluations with private surface owners, WOGCC personnel, BLM, and/or USFS;
- Submit site-specific applications (e.g., Surface Use Plan of Operations [SUPO]) to the appropriate SMA and modify them, as needed;
- Submit detailed construction or engineering plans, as needed, to the appropriate SMA;
- Collect four baseline water samples, if landowner access is granted, in accordance with WOGCC rules and regulations, prior to the setting of the well conductor casing. See **Section 2.7.3** for additional information.

EOG would obtain required permits from the BLM, USFS, and/or WOGCC prior to initiating surface disturbing activities on federal or State lands or minerals. To initiate the federal permitting process, EOG would file an NOS and/or APDs to the BLM and/or State for each proposed well. The agencies would process the applications to determine if they meet all requirements and would subsequently notify EOG of dates, times, and places to meet and conduct onsite inspections of the proposed locations.

Applications for Permit to Drill would be technically and administratively complete, and would generally consist of a SUPO, 10-Point Drilling Plan, evidence of bond coverage, accompanying information/exhibits/maps that might be required by the BLM, and a surface reclamation plan. A SUPO would typically contain information describing construction operations, access road(s), pipeline corridors (i.e., Secondary Corridors and associated Primary Corridors), water supply and

haul route, well site layout, production facilities, waste disposal, and restoration or reclamation associated with the well development proposal. Applications for Permit to Drill for the Greater Crossbow Project would, as appropriate, include information relative to other wells already drilled from the proposed ODP. The drilling plan would generally include information describing the technical drilling aspects of the specific proposal, including subsurface resource protection. The BLM would determine the suitability of the proposed design, construction techniques, and procedures during the APD review process.

2.4 CONSTRUCTION

Construction operations would conform to standards described in Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development ("*Gold Book*") (BLM and USFS 2007), lease stipulations, and EOG-committed project design features. On private lands, construction operations would be completed in accordance with surface owner preferences. Construction operations would generally occur during daylight hours. Anticipated surface disturbance from construction activities is summarized in **Section 2.4.5.**

2.4.1 OPTIMIZED DEVELOPMENT PADS

Conceptual locations for 86 of the 100 proposed ODPs are illustrated on **Figure 1**. Following completion of the ROD, site-specific locations for the ODPs would be determined in cooperation with the private surface owner, State, USFS, and/or BLM. On private surface, the surface owner would ultimately dictate placement of the ODP.

Construction of an ODP would typically entail the use of crawler tractors, motor graders, Class 125 or larger track hoes, backhoes, 10- to 20-yard dump trucks, and Class 988 loaders. ODP construction equipment needs would vary depending on site-specific conditions.

ODPs would be constructed from the native soils and rock material present on site at each ODP location. Topsoil and native vegetation would be stripped and stockpiled at the pad footprint. The stockpiling of topsoil and stripped vegetation would allow for a seed bank that should assist the re-establishment of existing vegetation. Locations would then be leveled by balancing cut and fill areas to the maximum extent possible to create a flat and level workable surface for drilling equipment while alleviating the need for imported materials. Compaction rates would be in compliance with American Association of State Highway and Transportation Officials (AASHTO)

requirements. The fill section of the pad would be compacted to support the drilling rig and any other heavy equipment. All cut and fill slopes needed for the ODP would be constructed so that stability would be maintained for the life of the Project. Cut and fill slopes would be designed to allow for the detention of topsoil and subsoil fill material.

Use of erosion control measures, including proper grading to minimize slopes, diversion terraces and ditches, mulching, terracing, riprap, fiber matting, temporary sediment traps, and broad-based drainage dips or low water crossings would be employed by EOG as necessary and appropriate to minimize erosion and surface runoff during construction, drilling, and production.

Construction materials required for surfacing the ODPs would be obtained from a contractor having a permitted source of materials within the general area. Gravel for the ODPs would typically be purchased from the Wright Pit located in Campbell County, Wyoming (Western Sunset LLC); Strock Pit located in Converse County, Wyoming; Quality Agg & Construction located in Campbell County, Wyoming; Collins Quarry located in Platte County, Wyoming; or Energy Basin LLC, located in Johnson County, Wyoming.

ODPs would initially be constructed to an appropriate size depending on the number of wells proposed for the location. For the purposes of analysis, it is assumed that following initial construction each ODP would be expanded an average of one time to accommodate additional wells. On average, wells would require 1.8 acres of initial disturbance per well. Following interim reclamation each well would require 1.4 acres of long-term disturbance. Given that the maximum number of wells proposed for a single ODP is 22 wells, the largest ODP proposed could be approximately 39 acres (1.8 acres of initial disturbance per well), consisting of approximately 19.7 acres for drilling and 18.9 acres for production facilities. Following interim reclamation a maximum-sized 22-well ODP would be reclaimed to approximately 28 acres (or 1.4 acres of long-term disturbance per well). Because EOG has proposed a total of 1,500 wells, in no event will all 100 ODPs be the maximum size of 22 wells per pad. For the purposes of analysis, EOG suggests using an average of 15 wells per ODP (1,500 wells divided by the maximum of 100 proposed ODPs). Total initial disturbance from ODP construction is anticipated to be approximately 2,700 acres of initial disturbance. Following interim reclamation, surface disturbance would be reduced to about 2,100 acres. The exact size and configuration of individual ODPs will be analyzed when site-specific development is proposed.

Compared to traditional oil and gas field development, EOG's ODP proposal would result in a substantial reduction of surface disturbance on a per well basis. For example, on average the long-term disturbance area for a typical horizontal well pad in the PRB is about 7 acres per well, which would equate to about 10,500 acres of long-term disturbance for 1,500 wells. Under the ODP strategy, each well would occupy a long-term disturbance area of about 1.4 acres, which is approximately an 80 percent reduction in per-well disturbance.

ODP construction would be supervised by a designated company representative who is familiar with the terms and conditions in the Record of Decision (ROD) for the EIS and approved APDs, as well as any specifications from private surface owners.

2.4.2 PIPELINE CORRIDORS

During the initial stage of the Greater Crossbow Project, water for drilling, oil, and produced water would be trucked to and from locations. However, EOG's ultimate goal is to substantially reduce oil and water truck traffic through their proposed pipeline corridor system. Specifically, EOG's proposed pipeline and utility line system for the project includes the development of a series of buried Primary Corridors that would consist of a variety of pipelines, Secondary Corridors that would connect buried flowlines from wells to the gathering lines, and cross-country pipelines as needed. EOG's Primary Corridors would tie into existing sales pipelines. Additional detail on the Primary Corridors, Secondary Corridors, cross-country pipelines, and construction methodology is provided below.

Primary Corridors

As illustrated on **Figure 1**, the Primary Corridors would generally trend in an east-west direction along section lines. In certain areas, the corridors jog to the north or south to accommodate private surface owner preference or to connect to an existing well pad. Similarly, as onsites occur, the locations of Primary Corridors may also be adjusted to the north or south to avoid sensitive natural resources such as raptor nests, cultural resources, streams, or wetlands, etc., and/or to accommodate additional surface owner preferences. The east-west Primary Corridors would generally be connected by north-south corridors.

As depicted in **Figure 1**, the strategic design of the Primary Corridors would result in a substantial reduction in overall surface disturbance compared to that of a traditional oil and gas field, where

pipelines and access roads are constructed in a “spider web” fashion across an entire project area. Instead, the locations of the Primary Corridors would result in substantial areas of land that would be left relatively undisturbed by new oil and gas activity, which would reduce overall disturbance and habitat fragmentation.

Primary corridors would include oil gathering pipe ranging from 4- to 12-inches outer diameter (OD); multiple high pressure gas pipe ranging from 4- to 24-inches OD; multiple low pressure gas pipe ranging from 6- to 36-inches OD; condensate pipe ranging from 4- to 12-inches OD; and fresh and produced water pipes ranging from 4- to 30-inches OD. High pressure gas pipe would be constructed of steel. All other pipe would be constructed of either steel, high-density polyethylene (HDPE), or equivalent. Based on the conceptual locations illustrated in **Figure 1**, there would be about 64 miles of Primary Corridor in the Greater Crossbow Project Area. The construction width of the primary corridors would be about 205 feet. Initial disturbance from construction of the Primary Corridors would be about 1,590 acres. Following pipeline installation, the entire pipeline corridor would be reclaimed with the exception of a small area (about 8 feet wide) that would be required for a two-track road needed for pipeline maintenance for the life of the project. Therefore, long-term disturbance from the Primary Corridors would be about 62 acres.

TABLE 3 summarizes the types, sizes, and capacity of pipelines proposed within the Primary Corridors.

TABLE 3

PIPELINES WITHIN PRIMARY CORRIDORS

LINEAR INFRASTRUCTURE	OUTER DIAMETER	CONSTRUCTION MATERIAL	MAOP (POUNDS PER SQUARE INCH (PSI))
Oil Gathering Pipeline	4-12"	Steel, HDPE, or equivalent	75-1440
High Pressure Gas Pipeline	4-24"	Steel, HDPE, or equivalent	1000-1440
Low Pressure Gas Pipeline	6-36"	Steel, HDPE, or equivalent	75-1440
Condensate Pipeline	4-12"	Steel, HDPE, or equivalent	75-1440
Produced Water Pipeline	6-30"	Steel, HDPE, or equivalent	125-1,500
Water Supply Pipeline	6-16"	Steel, HDPE, or equivalent	125-1500-335

Secondary Corridors

Secondary Corridors would typically consist of a 200- to 400-foot long pipeline corridor designed to connect oil, gas, condensate, produced water, and water supply flowlines from the wells on an ODP to the larger diameter pipelines in the Primary Corridors. Flowlines would range from 2 to 20inches OD. Flowlines would either be constructed of steel, HDPE or equivalent. Based on an average of a 250-foot long Secondary Corridor per ODP, there would be approximately 25,000 feet or about 5 miles of Secondary Corridor within the Greater Crossbow Project Area. The construction width of the secondary corridors would also be about 205 feet. Initial disturbance from construction of the Secondary Corridors would be about 124 acres. Following pipeline installation, the entire pipeline corridor would be reclaimed with the exception of a small area (about 8 feet wide) for a two-track road needed for pipeline maintenance for the life of the project. Therefore, long-term disturbance of the Secondary Corridors would be about 5 acres.

Primary Corridor Connectors/Cross-Country Pipelines

To provide connection between primary corridors and in other limited situations, for example to substantially reduce total pipeline length or where dictated by the surface owner, a proposed corridor connector or cross-country pipeline corridor could be installed. Conceptual locations for primary corridor connectors and cross-country pipelines are not illustrated on **Figure 1**. All corridor connectors and cross-country pipelines would be buried and would require a 205-foot construction width. Cross-country pipelines would be constructed of either steel, HDPE, or equivalent. Cross-country pipelines could total approximately 20 miles. Initial disturbance from construction of cross-country pipelines would be about 496 acres. Following pipeline installation, the entire pipeline corridor would be reclaimed with the exception of a small area (about 8 feet wide) that would be required for a two-track road needed for pipeline maintenance for the life of the project. Therefore, long-term disturbance of the cross-country pipelines would be about 20 acres.

Pipeline Construction Methodology

Pipeline construction methodology would be consistent amongst Primary, Secondary, connectors, and cross-country pipeline corridors. The approved corridor, USFS SUA or SUP, or WY TUP would be cleared using a grader. Scrub vegetation such as sagebrush, greasewood, grasses, etc., would be scalped and temporarily windrowed along the edge of the corridor. Scalping would remove surface vegetation, while allowing the root systems to remain in place thereby reducing potential erosion and allowing more successful reclamation.

Backhoes or trenching machines would then be used to excavate/ditch the pipeline trench. Soil that is excavated during ditching operations would be temporarily stockpiled on the non-working side of the trench. Trenches would not be left open longer than 48 hours if possible, and soft plugs would be installed every ¼ mile when the trench is left open overnight.

Oil, gas, condensate, produced water, and water supply pipe would be strung along the trench and fused or welded prior to being lowered into the trench. Specifically, individual joints of pipe would be strung along the trench corridor adjacent to the excavated ditch and arranged so they are accessible to construction personnel. All fused connections would then be visually inspected, and all welded connections would be x-rayed to requirements of API 1104. The pipe assembly would then be lowered into the trench by side-boom tractors. Tracer wire would be installed in the ditch, which would be used for future locating purposes. Each pipe would be buried a minimum of 42 inches deep with the exception of areas where rock is encountered that requires ripping or shooting. The different types of pipe would be spaced apart in accordance with industry standard safety requirements.

Where pipelines are installed adjacent to access roads they would be installed at least 5 feet from the edge of the road. Where proposed pipelines intersect paved roads, the road would be bored under and the pipe would be pulled back through the bore. Pipelines would be buried at least 5.5 feet deep under all roads.

Following installation of all proposed pipe material, the trench would be back-filled and packed using backfilling or bladed equipment.

Pipeline construction activities would be confined within the approved pipeline corridor, USFS SUA or SUP, or WY TUP. All pipeline construction activities would cease when soils or road surfaces are frozen or become saturated to the extent that construction equipment is unable to stay within the approved corridor and before activities cause irreparable harm to roads, soils, or excessive siltation of nearby lakes, reservoirs, or live flowing streams. Sedimentation and erosion control features along the pipeline corridors would be constructed as needed, in accordance with Best Management Practices (BMPs) and a Storm Water Pollution Prevention Plan (SWPPP).

As previously described, pipeline corridors would be constructed to an initial disturbance width of approximately 205 feet.

2.4.3 ACCESS ROADS

Primary access to the Project Area is from Highway 59 south of the Project Area by the towns of Bill or Wright, Wyoming. As feasible and as authorized by the SMA or private surface owner, new access roads would be constructed off existing well field and two-track ranch roads to access each proposed ODP. However, most access roads would be located on private surface, and due to private owner restrictions, access roads would not necessarily be constructed in-line with the Primary Corridors. As such, locations for new access roads would generally be dictated by the respective surface owner(s). Existing roads, upgraded roads, and newly built roads would be maintained in the same or better condition than existed prior to EOG operations and would meet the standards outlined in the Gold Book (BLM and USFS 2007). Roads would be maintained until abandonment and reclamation of wells. Where roads are needed on federal surface, EOG would obtain a USFS SUA or SUP, or WY TUP

Roads would be constructed in accordance with Gold Book standards (BLM and USFS 2007). New roads would be completed as a single-lane, crowned, with an 18- to 22-foot-wide running surface and 60 feet of subgrade. Turnouts would be installed as needed every 500 to 800 feet for visibility depending on topography (e.g., blind curves), per Gold Book standards. Turnouts would be approximately 24 feet wide and 40 to 60 feet long. Access roads would be constructed with a 4:1 slope for ditches, and rip rap would be used along the slopes as needed for stabilization. A minimum of 6 inches of topsoil would be stripped from new access roads prior to any further

construction activity. Stripped topsoil would be stored along the sides of the new access roads and stabilized by seeding and/or matting, as appropriate.

Roads would be constructed with wing ditches and culverts installed as necessary to provide proper drainage along the access road route. Sedimentation and erosion control features along the access roads would be constructed as needed, in accordance with BMPs and a SWPPP. In the event that commercial production is established from the subject wells, the access road would be surfaced to an average minimum depth (after compaction) of 4 inches with 3-inch minus pit run gravel or crushed rock, if required by the SMA or private surface owner.

Construction activity would not be conducted using frozen or saturated soils material or during periods when watershed damage is likely to occur. If access roads are dry during construction, drilling, and completion activities, water would be applied to the access roads to help facilitate road compaction (during construction), provide dust abatement, and minimize soil loss as a result of wind erosion.

As previously stated, locations for access roads have not yet been determined since ODP locations have not been onsited, nor have permissions been secured by private surface owners. However, about 95 miles of upgraded or new access roads are estimated to be needed. Where agreed upon by the surface owners, new access roads would follow the Primary Corridors. As such, the estimated length of access roads required was calculated based on the total length of the proposed Primary Corridors (about 64 miles), plus an additional 30% (19 miles) where landowners are anticipated to prohibit new access roads along the Primary Corridors, plus an estimated 20 miles of north-south trending access roads that would be required to connect the Primary Corridors. Total length of new access roads is anticipated to be about 103 miles. Average initial surface disturbance width for access roads would be approximately 60 feet wide. Therefore, access road construction would result in the initial disturbance of approximately 749 acres. Following interim reclamation, road corridor widths would be reduced to 40 feet, resulting in long-term disturbance of approximately 499 acres.

2.4.4 WATER SOURCE WELLS/WATER STORAGE PONDS

EOG currently has 4 water source wells and would construct up to 10 additional wells and associated water storage ponds that would supply water for drilling, completion, and dust suppression. As feasible and authorized, water source wells would be drilled from locations along the Primary Corridors, and a water storage pond would be located adjacent to each water source well. Construction of the pads supporting the water wells would require substantially less dirt transport than the construction process for the ODPs. Each water source well pad would initially be constructed to approximately 4 acres, for a total initial disturbance of approximately 40 acres. Following interim reclamation each water source well pad would be reduced to approximately 2 acres, for a total long-term disturbance of approximately 20 acres. Each water storage pond would include approximately 9 acres of initial and long-term disturbance, would be approximately 35 feet deep (3:1 slope), and would have a storage capacity of approximately 100 acre feet.

To prevent water from freezing at the water source wells while they are being used for well completion, there would be a total of five 35 million British thermal units per hour (MMbtu/hr) gas powered water heaters. The heaters could be utilized 24 hours per day between the months of October and May to provide necessary hot water during completion activities.

2.4.5 ELECTRIC UTILITY LINES

As economically feasible and as drilling continues, production facilities on the ODPs would be electrified, thereby reducing air emissions.

Electrical power in Converse County is provided by Rocky Mountain Power. Electrical power in Campbell County is provided by Powder River Energy Corporation (PRECorp).

Electrification of the production facilities would be achieved by running a combination of 15 to 25 kilovolt (kV) distribution utility lines to the ODPs from transfer stations operated by PRECorp and Rocky Mountain Power. For analysis purposes it is assumed that each ODP would require about 1 mile of buried electric utility line corridor for a total of 100 miles. All EOG owned and operated distribution lines would be buried. Installation of the proposed electric utility lines would initially require a 20-foot wide disturbance corridor (electrical lines would be outside of pipeline corridors).

Utility lines would be installed using a technique called “plowing.” The plowing system uses a specially designed plowshare, blade, or lamella that is pulled through the ground using a strong wire cable attached to a towing unit or a wheeled/tracked towing unit. The blade runs through the ground at a pre-set depth to create a trench. The cable is laid immediately behind the plowing blade before the trench has time to collapse or fill with soil. A second blade on the plow is used to return the material, opened out of the trench by the first blade, to its original position thereby closing the excavation.

Following installation of the distribution lines, the disturbance corridor would be reclaimed with the exception of an approximately 8-foot wide swath that would be needed for a two-track road for maintenance of the utility lines. Long-term disturbance of the utility line corridors would therefore be approximately 97 acres.

Any permitting requirements for powerlines would be the responsibility of the power company as the third-party supplier.

2.4.7 DUST ABATEMENT

Dust abatement would be implemented as needed, where dry conditions exist, or where authorized by the surface owner during construction activities. In general, water would be used for dust abatement purposes. However, magnesium chloride could also be used as needed or authorized by the surface owner. In general, EOG would use up to 1,200 barrels (bbl) of water for the construction of an individual ODP, and up to 1,500 bbl of water for the construction of 1 mile of access road and/or pipeline corridor. Water sources for dust abatement are discussed in **Section 2.6**.

2.4.8 SURFACE DISTURBANCE ESTIMATES

Anticipated surface disturbance by design feature is summarized in **Table 4**.

As previously discussed, compared to traditional oil and gas field development, EOG’s ODP proposal would result in a substantial reduction of surface disturbance on a per well basis. For example, on average the long-term disturbance area for a traditional well pad in the PRB is about

7 acres per well, which would equate to about 10,500 acres of long-term disturbance for 1,500 wells. Under the ODP strategy, each well would occupy a long-term disturbance area of only about 1.4 acres, with a total of about 2,100 acres, which is approximately an 80 percent reduction in per well disturbance compared to traditional development. Similarly, the placement of ODP locations along strategically placed Primary Corridors would result in a substantial reduction in overall surface disturbance compared to that of a traditional oil and gas field, where pipelines and access roads are constructed in a "spider web" fashion across an entire Project Area. The design of the Greater Crossbow Project would result in substantial areas of land that would be left relatively undisturbed by new oil and gas activity, which would reduce overall surface disturbance and habitat fragmentation.

TABLE 4

SURFACE DISTURBANCE UNDER THE GREATER CROSSBOW PLAN OF DEVELOPMENT

DESIGN FEATURE	NUMBER	LENGTH (MILES)	INITIAL WIDTH (FEET)	INITIAL FACILITY SIZE (ACRES)	INITIAL DISTURBANCE (ACRES)	LONG-TERM WIDTH (FEET)	LONG-TERM FACILITY SIZE (ACRES)	LONG-TERM DISTURBANCE (ACRES)
ODPs	100	NA	NA	27*	2,700	NA	21**	2,100
Primary Corridors	NA	64	205	NA	1,590	8	NA	62
Secondary Corridors	NA	5	205	NA	124	8	NA	5
Corridor Connectors/Cross-Country Pipelines	NA	20	205	NA	496	8	NA	20
Access Roads	NA	103	60	NA	749	40	NA	499
Water Wells	10	NA	NA	4	40	NA	2	20
Water Storage Ponds	10	NA	NA	9	90	NA	90	90
Electric Utility Lines	NA	100	20	NA	242	8	NA	97
Compressor Stations	10	NA	NA	10	100	NA	10	100
TOTALS	NA	NA	NA	NA	6,131	NA	NA	2,993

*Assumes an average of 15 wells per ODP at 1.8 acres of initial disturbance per well.

**Assumes an average of 15 wells per ODP at 1.4 acres of long-term disturbance per well.

2.5 DRILLING AND COMPLETION

The following sections describe EOG's plan for drilling and completion in the Greater Crossbow Project Area. To the greatest extent possible, EOG intends to conduct drilling, exploration, and development operations within the Project Area on a year-round basis to maximize the use of horizontal development from multi-well pads. As part of this PoD, EOG is seeking approval from the BLM to waive discretionary timing limitations on a programmatic basis (e.g., several wells on specific ODPs). Without this waiver, the application of timing limitations would force EOG to move drilling rigs in and out of areas during portions of the year, which would increase operational costs, decrease efficiencies, and potentially increase impacts to wildlife and other sensitive resources.

2.5.1 DRILLING

Following construction, drilling rigs would be transported to the well site and erected on the ODP. Current technology may allow each rig to drill 30 wells each year, depending on the formation. Approximately eight drill rigs are anticipated to be operating in the Greater Crossbow Project Area at the peak of the drilling phase. The actual number of rigs in the Project Area and number of wells drilled during a given year would be dependent on the factors identified in **Section 2.2**.

All equipment and vehicles associated with drilling activities would be confined to the approved disturbance areas of the roads and ODPs. Wells would be drilled and completed in accordance with WOGCC rules and regulations, BLM Onshore Oil and Gas Order No. 2, and other current BLM guidelines. Detailed well construction plans would be included in the APD for any given well.

Horizontal wells would be drilled vertically from each surface location to a predetermined point above the target formation, referred to as the "kickoff point." From here, the wellbore would curve from its vertical trajectory to intersect the target reservoir at the "entry point," then continue horizontally through the reservoir until reaching the desired bottom-hole location. Wells would be drilled to varying total measured depths (approximately 16,000 to 20,000 feet[2]) to the Parkman, Turner, Mowry, Niobrara, Muddy, or possibly other formations. Drilling would determine whether

[2] Total Measured Depth range based on estimates provided by EOG for the Parkman, Turner, and Mowry Formations.

oil and gas production could be established. As soon as evaluation of the production intervals is conclusive, any unproductive drill holes would be plugged and abandoned in accordance with state and Onshore order requirements.

All proposed wells would be drilled using a closed-loop system, therefore no open reserve or cuttings pits would be needed. The closed-loop system would consist of five above ground tanks, varying in size from 30 to 80 cubic yards, for the containment of drill cuttings; and four 500-barrel (bbl) upright tanks for water-based mud storage. The storage area for these tanks would include a plastic liner and containment berms. There would be five 500 bbl upright tanks for oil-based mud storage. The containment area for these tanks would also be lined with a plastic liner and containment berms. The drill rig would also be set atop a plastic liner. All liners would be 16 mil thick.

Siphons, catchments, drip pans, and absorbent pads would be installed to keep hydrocarbons produced by the drilling and/or completion rigs from contaminating surrounding soils. Hydrocarbons and contaminated pads would be disposed of in accordance with Wyoming DEQ requirements.

During drilling operations, a blowout preventer would be installed on the surface casing to provide protection against uncontrolled entry of reservoir fluids into the wellbore in the event that reservoir pressures exceed the hydrostatic pressure of the wellbore fluid. In addition, a flow control manifold consisting of manual and hydraulically operated valves would be installed at ground level. All pressure-control devices would comply with the provisions of BLM's Onshore Oil and Gas Order No. 2.

The casing and cementing program would be designed to protect wellbore integrity, isolate, and protect the shallower formations encountered in the wellbore, and prohibit pressure communication or fluid migration between zones. In addition, the cement would protect the well by preventing formation pressure from damaging the casing and retarding corrosion by minimizing contact between the casing and formation fluids. EOG may also run downhole evaluation logs prior or subsequent to setting and cementing production casing. Detailed site-specific casing and cementing plans for each well would be included with each federal APD package and approved by a BLM and/or State petroleum engineer.

Drilling operations for an individual well could require from 8 to 20 people, who would access an ODP with 4 to 10 vehicles. The duration of drilling operations on a given well would vary depending on the target formation, well depth, wellbore geometry, and/or conditions encountered while drilling. However, in general an individual well could be drilled in 7 to 20 days depending on the target formation[3]. For the purpose of analysis in the Air Quality Emissions Inventory it is assumed that it would take an average of 7.5 days per oil well and 17.5 days per gas well.

Depending on the formation drilled, each well would require anywhere from 3,700to 4,400 bbl[4] of water to perform drilling operations. Water for drilling would be obtained from the sources identified in **Section 2.6**.

2.5.2 COMPLETIONS

Completion operations would commence after a well is drilled and the potential well productivity has been determined. Completion operations consist of perforating the production casing, stimulating the formation(s) using hydraulic fracturing techniques, flowing back the fracturing fluids to the surface, flow testing to determine post-fracture productivity, and installation of production equipment.

After production casing is perforated, stimulation would consist of hydraulically fracturing the producing formation. A water/sand slurry would be used with gels and other additives to ensure the quality of the fracture fluid. Slurry would be pumped down the well bore through perforations in the casing and into the formation. Pumping pressures and slurry flow rates would be increased to the point at which fractures propagate outward from the perforations into the formation and the slurry flows rapidly into the fractures. The sand serves as a proppant to keep the created fracture open after the pressure drops, thereby allowing reservoir fluids to move more readily into the well.

[3] Drilling timeframe based on estimates provided by EOG for the Parkman, Turner, and Mowry Formations.
[4] Water volumes for drilling based on estimates provided by EOG for the Parkman, Turner, Mowry, and Niobrara Formations.

Hydraulic fracturing is a well understood and commonly employed technology used on potentially productive reservoirs at depths below usable aquifers. Hydraulic fracturing processes and required disclosures would be conducted in accordance with all current and future WOGCC, BLM, and any other applicable rules. The WOGCC requires operators to disclose the types and amounts of hydraulic fracturing chemicals used prior to stimulation (WOGCC 2010). EOG would also disclose the contents of hydraulic fracturing fluid used in the proposed wells to the public through FracFocus, a website managed jointly by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission (http://fracfocus.org). The website allows the public access to general information, water volumes, and chemical information for registered wells in a format consistent with material safety data sheets, including the Chemical Abstract Service number and the ingredient percentage in both the additive and hydraulic fracturing fluids. This registry provides a means for oil and gas operators to voluntarily provide key information to the public in a timely fashion. In addition, EOG would comply with U.S. Environmental Protection Agency (EPA) requirements 40 CFR Part 60, Subpart OOOO that requires notification 2 days prior to completion of any gas well that will include hydraulic fracturing.

EOG would utilize "green completions" on new wells to limit the venting or flaring of natural gas. According to Wyoming Air Quality Standards and Regulations (WAQSR) Chapter 6, Section 2, Oil and Gas Production Facilities Permitting Guidance (September 2013), wells located in Converse and Campbell counties are not required to utilize “green completions.” However, all gas well completions with hydraulic fracturing must follow specific “green completion” guidelines according to 40 CFR Part 60, Subpart OOOO. Under Subpart OOOO these wells must recover liquids during flowback and route to storage tanks or re-inject them. All recovered gas shall be re-routed, used, or put into a collection system with no direct release to the atmosphere. Only if recovered flowback gas cannot be put to a gas flow line, may it be captured and flared.

Economically viable wells would be connected to permanent production facilities and wells would be turned to production through those facilities. Post stimulation flow tests would allow for recovery of stimulation fluids and evaluation of well productivity. Recovered fluids would include variable amounts of produced water in addition to stimulation fluids. Flow testing duration would vary depending on individual well performance but typically would be conducted only long enough for fluid rates to drop to a level that permanent production equipment can safely process. Portable and/or permanent production equipment would be utilized to separate fluids from the flow back

stream, allowing recovered fluids to be directed to storage tanks. Fluids recovered during flow back operations would be transported from the storage tanks to an approved disposal facility. Oil would be contained in tanks and ultimately sold.

Wells drilled to the Turner or Mowry formations would not be flared. Instead, they would be shut in until connected to pipeline. Wells drilled to the Parkman Formation would typically be flared for up to 14 days after initial production, and then EOG would either secure a permit to continue flaring or shut in the well until connected to pipeline. If there is an emergency upset in the gathering system EOG is authorized to flare gas under WOGCC Chapter 3 Section 39. If a shutdown is longer than 24 hours EOG is required to secure a permit to flare over the shutdown period or to the maximum volume that the state allows. In addition, in accordance with the U.S. Department of the Interior NTL-4A memo, "Royalty or Compensation for Oil and Gas Loss," EOG is authorized to flare gas without incurring a royalty obligation in an emergency situation. Under Part III of the memo, Authorized Venting and Flaring of Gas, a temporary emergency situation is authorized for up to 24 hours per incident, and up to 144 hours during any calendar month. All other applicable requirements within the NTL-4A memo or future regulations would be followed as well.

Completion operations for an individual well could require from 4 to 30 people who would access the ODP with 2 to 20 vehicles. Depending on the formation, an individual well could be stimulated and completed in on average 17 days, which is consistent with what is assumed for completion timeframes in the Air Quality Emissions Inventory [5].

About 300,000 bbl of water[6] would be required to complete an individual well regardless of the target formation. Water for completions would be provided by 4 existing and 10 proposed water source wells. In addition, as feasible, EOG would use a limited volume of treated or recycled water during completion operations. See **Section 2.6.2** for additional information on proposed water use.

[5] Completion timeframe based on estimates provided by EOG for the Parkman, Turner, and Mowry formations.
[6] Water volumes for completion based on estimates provided by EOG for the Parkman, Turner, Mowry, and Niobrara formations.

If a well is determined to be non-productive, the well would be completed as a dry hole. In accordance with 43 CFR 3160, a Well Completion Report and Log (Form 3160-4) would be submitted within 30 days after completion of each well or after completion of well operations being performed.

2.6 WATER REQUIREMENTS AND WATER SOURCES

2.6.1 WATER REQUIREMENTS

Water requirements for construction, drilling, completion, and dust abatement are summarized in **Table 5**.

TABLE 5

WATER REQUIREMENTS FOR THE GREATER CROSSBOW PROJECT

PROJECT PHASE/TASK	WATER VOLUME (TOTAL BBL)
Dust Abatement During Construction	
Per ODP	1,200
Per One Mile of Access Road/Pipeline Corridor	1,500
Drilling (Per Well)	
Parkman	3,700
Turner	4,400
Mowry	4,100
Niobrara	3,300
Completion (Per Well)	
Parkman	300,000
Turner	300,000
Mowry	300,000
Niobrara	300,000
Dust Abatement During Production	
Per One Mile of Access Road	1,500

2.6.2 WATER SOURCES

Water for drilling, completion, and dust abatement would be obtained from approved, permitted, and new sources. Existing water sources would include four existing water wells located within

the Greater Crossbow Project Area, as well as permitted water sources outside the Project Area. EOG is also proposing to drill ten new water source wells to aquifers that would be drilled on or near the Primary Corridor system. Each of these new water source wells would also have an adjacent water storage pond. Specific locations of proposed water source wells and ponds are anticipated to be located on private lands. All water source wells would be properly permitted and approved through the Wyoming State Engineers Office, and in coordination with the private surface owner.

Water for drilling and completion would initially be trucked to the ODPs. However, as the Primary Corridor system is developed, water would also be piped to the ODPs, thereby reducing water truck traffic. The specific water sources for an individual well would be identified at the time of APD submittal.

2.7 PRODUCTION FACILITIES AND OPERATIONS

Each ODP would include the wellheads and potential pumpjacks, and then separate production equipment located and operated on a portion of the ODP separate from the wellheads. The primary purpose of the production equipment is to separate the well stream into three components "phases" (oil, gas, and water), and process these phases into marketable products or prepare them to be disposed of in an environmentally acceptable manner. During normal operations, the liquids would temporarily be stored on location in tanks, and from these tanks the products would be trucked or piped offsite as soon as practical.

Power required for the production equipment would initially be provided via gas-driven engines, but as technically and economically feasible would eventually be replaced with purchase power (i.e., commercial electricity) (**Section 2.7.4**).

Production equipment per 15-well ODP could include up to the following equipment (if authorization for comingling is provided, the number of tanks required would be reduced substantially):

- 50 oil storage tanks between 400 and 750 bbl (up to 37,500 bbl of total storage) (an average of approximately 3.3 oil storage tanks per well)

- 20 water storage tanks between 400 and 750 bbl (up to 15,000 bbl of total storage) (an average of approximately 1.3 water storage tanks per well)
- 15 emergency storage tanks between 100 and 500 bbl (up to 7,500 bbl of total storage) (an average of less than 0.67 emergency storage tanks per well)
- 15 triethylene glycol (TEG) dehydration units
- 15 glycol heaters
- 15 pumping units
- 15 high pressure separators
- 15 fuel gas scrubbers
- 15 sales gas scrubbers
- 15 horizontal or vertical heater treaters
- 15 indirect heaters
- 15 low pressure combustors or flares and flare knockout vessels
- 15 high pressure flares and flare knockout vessels

The gas produced on location would be separated by the production equipment and piped offsite. Gas from high pressure wells may be dehydrated before being piped off location.

Vapor from the tanks would be controlled with low-pressure combustors or flares with flare knockout vessels.

Actual operations of the production equipment would be dependent on the success of the exploratory wells. The quantity of equipment and configuration could change to accommodate lower or higher quantities of gas or liquids recovered from exploratory wells.

2.7.1 MIDSTREAM[7]

Compression

EOG anticipates an estimated 125,000 horsepower (HP) of new EOG-provided compression within the Project Area for gathering and gas lift; additional compression may be acquired from third party providers. Some compression would be located on the ODPs and additional compression would require up to 10 new, approximately 10-acre compressor stations throughout the Project Area. The construction process for compressor stations would be similar to the construction process for an ODP, as described in **Section 2.4.1**.

Processing of Natural Gas

Processing of natural gas would be done at existing plants and potential future third-party processing plant facilities.

Residue Gas

Transportation of plant residue gas would be done through existing pipelines and potential future EOG or third party new build pipelines. Residue would be transported to local markets or exported by pipeline out of state.

NGL Liquids

[7] Section 2.7.1 discusses the possibility of future natural gas processing plants, residue gas pipelines, and NGL pipelines. However, at this time these are speculations, and EOG has no ability to determine if and where such facilities/infrastructure would be located.

Plant NGL liquids would be sold into the local market, trucked to NGL liquid terminals, loaded onto rail cars for export out of state, or transported through existing pipelines or potential future EOG or third party new build pipelines out of state.

2.7.2 GROUNDWATER SAMPLING

EOG has developed a Groundwater Baseline Sampling Program to establish baseline groundwater conditions in the vicinity of new oil and gas well locations before drilling begins. This program meets the requirements and protocols established in Chapter 3, Section 46 of the WOGCC Rules and Regulations for the groundwater baseline sampling, analysis, and monitoring program.

Water samples would be collected from up to four water wells located within 0.5 mile of the surface location in a radial pattern from a proposed oil or gas well. These baseline samples would be collected prior to the setting of the well conductor casing. Sampling would only be conducted if landowner access is granted.

Post-completion sampling and analysis would be performed between 12 and 24 months and between 36 and 48 months after setting the production casing or liner. Post-completion samples may also be collected from wells from which baseline samples were collected in response to landowner complaints of a distinct or measurable change in water quality (i.e., change in odor, color, taste, or turbidity). Every effort would be made to perform post-completion sampling during the same month that baseline sampling is performed.

2.7.3 PRODUCED WATER MANAGEMENT AND DISPOSAL

Produced wastewater would be confined to a storage tank for a period not to exceed 90 days after initial production of an individual well. During the early stages of the Greater Crossbow Project, produced water would be trucked for disposal to one of the following locations: McBeth Water Disposal, North Douglas Water Disposal, Lynch Water Disposal, or the North Bill Disposal. However, EOG intends to eventually convert four of their producing wells to salt water disposal (SWD) wells, to which produced water would be piped via the Primary Corridor system. Locations

for SWD wells would be determined based on reservoir injection quality. All SWD wells would be properly permitted and approved through the WOGCC or Wyoming DEQ.

2.7.4 WORKOVERS AND RECOMPLETIONS

Periodically, EOG may perform a workover on a well to keep the well operating efficiently. Workovers may be necessary to repair the wellbore equipment (casing, tubing, etc.) and/or the wellhead, or to improve well performance. EOG may also recomplete a well to produce oil or natural gas from a different interval in a wellbore. Both workover and recompletion operations generally occur during daylight hours. A typical workover or recompletion operation would require approximately 3 days; however, they can range from 1 to 10 days, or more, depending on the complexity of the work required. Manpower requirements for these operations average 6 people, ranging from 4 to 30 people at a particular time. The frequency for this type of work cannot be accurately projected since workovers and/or recompletions vary by well and depend on well-specific circumstances. Both workovers and recompletions would be performed in accordance with appropriate requirements. Neither operation would result in additional surface disturbance.

2.7.5 HAZARDOUS MATERIALS AND SOLID WASTE

A variety of chemicals, including lubricants, paints, and additives, would be used during drilling and completion operations. Some constituents of these materials contain hazardous substances. Hazardous materials can include some greases or lubricants, solvents, acids, paint, and herbicides, among others. These materials would not be stored at well locations although they may be kept in limited quantities on drilling sites and at production facilities for short periods of time. None of the chemicals that would be used during drilling, completion, or production operations meet the criteria for being an acutely hazardous material/substance or meet the quantities criteria per BLM Instruction Memorandum No. 93-344. Chemicals subject to reporting under Title III of the Superfund Amendments and Reauthorization Act in quantities of 10,000 pounds or more would not be used, produced, stored, transported, or disposed of annually while drilling or completing a well in the Greater Crossbow Project Area. In addition, extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, would not be used, produced, stored, transported, or disposed of while drilling or completing a well.

Most wastes that would be generated by the Project are excluded from regulation by the Resource Conservation and Recovery Act (RCRA) under the exploration and production exemption in Subtitle C (40 CFR 261.4(b)(5)) and are considered to be solid wastes. These wastes include those generated at the wellhead and through the production stream or gas plants. Exempt wastes include produced water, production fluids (i.e., drilling mud or well stimulation flow-back fluids), and soils affected by spills of these fluids.

Any unintentional release of oil, gas, salt water, or other such fluids would be immediately addressed by onsite remediation and /or removal to an approved disposal site. The spill would be reported to the Authorized Officer (AO) of the appropriate SMA and other appropriate authorities. EOG would develop and maintain a Spill Prevention, Control, and Countermeasures (SPCC) Plan for each well in the Project Area. To satisfy SPCC Plan requirements, storage facilities and tanks would use secondary containment structures of sufficient capacity to contain, at a minimum, the entire contents of the largest tank, with sufficient freeboard to contain precipitation after the well goes into production. Any spills or releases of regulated wastes or materials would be investigated, responded to, and remediated in accordance with BLM, USFS, WOGCC, EPA, and WDEQ regulations and guidance.

Drill cuttings would be stored on the ODP in a containment tank at each well location. Fracture stimulation fluids would be flowed back into above-ground tanks and hauled to a WDEQ-authorized disposal site.

Portable chemical toilets would be provided for the use of workers during well drilling and completion operations. Toilets would be pumped as required and the waste disposed of by a commercial operator.

All garbage and non-flammable waste materials would be stored in self-contained portable dumpsters or trash cages. Trash and debris would be picked up daily and deposited in an appropriate container. As needed and upon completion of operations, accumulated trash would be cleaned up and removed from the location and transported to a state-approved waste disposal site. Immediately upon removal of the drilling equipment, the container would be removed from the site until such time as the next well is to be drilled on the ODP.

2.7.6 RECLAMATION AND ABANDONMENT

Reclamation activities would be conducted in accordance with Greater Crossbow Oil and Gas Exploration and Development Project Programmatic Reclamation Plan (SWCA 2015) (see Appendix A) and in conformance with the preferences of the appropriate SMA or private surface owner. In addition, EOG would comply with the Wyoming Reclamation Policy as currently expressed in BLM Wyoming Instruction Memorandum 2012-032 (4/2/12). EOG's reclamation strategy would remain adaptive to address results from ongoing monitoring and would implement advances in reclamation. EOG's reclamation goals would include:

- developing procedures and strategies to ensure successful interim and final reclamation operations in the Greater Crossbow Project Area;
- modifying procedures and strategies as needed throughout the life of the Project;
- developing procedures for reclamation monitoring and reporting; and
- evaluating reclamation performance on an ongoing basis in terms of successful site stabilization.

2.8 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES (ACEPMS)

EOG voluntarily incorporates several design features, federal and state requirements, BMPs, and conservation measures into their SUPOs to alleviate or reduce resource impacts. Project activities would also follow practices and procedures outlined in the appropriate land use plan, each individual APD, and any Conditions of Approval (COAs) appended by the SMA.

As feasible and authorized, the following Project design features would be used for all locations in the Greater Crossbow Project Area:

Surface Disturbance and Erosion Control

- EOG would use grading, site preparation BMPs, and other soil retention measures to mitigate potential soil losses and other erosive forces.
- EOG would design all well pads to prevent storm water and sheet flow from entering the well pad.

- EOG would apply 30-day stabilization measures for sandy soils and wind erosion.
- EOG would modify reclamation procedures and strategies as needed and would evaluate reclamation performance on an ongoing basis in terms of successful site stabilization.
- EOG would locate access roads alongside Primary and Secondary Corridors where authorized and feasible.
- Although not required on non-federal lands, EOG construction operations (e.g., ODPs, access roads) would conform to standards described in the Gold Book.

Air Quality

- EOG would use water and/or water with commercial suppressants for dust abatement on access roads, if needed.
- EOG would recover gas that would otherwise have been vented or flared during testing operations from both oil and gas wells. These “green completions” may use portable flow-back equipment and/or permanent production equipment, depending on site-specific conditions. Use of this equipment would allow the transport of gas and oil to sales and prevent waste.
- All production equipment at well sites and at the centralized facilities would be fitted with low-bleed controls.
- Production tank venting emissions would be minimized through the use of a low-pressure combustors or flares with flare knockout vessels. As technically and economically feasible, ODP facilities would be electrically powered.
- Truck traffic would be reduced through the use of Primary Corridors.
- EOG would use well head telemetry for remote monitoring once a well is in production to reduce maintenance traffic.

Cultural and Paleontological Resources

- A Class I cultural resource literature review is currently being conducted for the entire Greater Crossbow Project Area.

- Class III cultural resource surveys are currently being conducted in areas proposed for surface disturbance, where authorized. If historic or archaeological materials were to be uncovered during construction, EOG would immediately stop surface disturbing activities that might further disturb such materials and contact the surface owner or AO.
- All EOG personnel would refrain from collecting artifacts and from disturbing any National Register of Historic Places eligible cultural resources in the area. EOG would be responsible for informing all persons in the area who are associated with this project that they may be subject to prosecution for knowingly disturbing historic or archaeological sites or for collecting artifacts. All vehicular traffic, personnel movement, construction, and restoration activities would be confined to the areas examined, as referenced in the archaeological report, and to the existing roadways and/or evaluated access routes.
- EOG would conduct a paleontological survey in sensitive fossil areas (Potential Yield Fossil Classifications 4 or 5) where bedrock is exposed or located sufficiently close to the surface to be disturbed by excavation activities. All EOG personnel would refrain from collecting fossils and from disturbing any scientifically important fossil in the Greater Crossbow Project Area. If fossils were to be uncovered during construction, EOG would immediately stop surface disturbing activities that might further disturb such materials and contact the surface owner or AO.
- Monitoring of all bedrock excavations would be performed by a qualified paleontologist when required by the surface owner or AO.

Vegetation and Noxious/Invasive Species

- EOG would control invasive and noxious weeds along ODPs, access roads, pipeline corridors, or other facilities as specified by surface owner, County, State, BLM, and USFS regulations. A list of noxious weeds would be obtained from the BLM or the appropriate County Extension Office.

Active Floodplains and Riparian Areas

- If project operations would create new surface disturbance within active floodplains or within 330 feet of riparian areas, and assuming there are no practical alternatives, EOG would work with the surface owner or AO to evaluate site-specific design features to

maintain and protect wildlife habitat, water quality, and appropriate land uses. The decision to implement site-specific design features within an active floodplain or within 330 feet of a riparian area would be determined on a well-by-well basis during the APD approval process.

Raptors, Migratory Birds, and General Wildlife

- EOG would adhere to seasonal and spatial buffers applicable to occupied raptor nests in the Greater Crossbow Project Area. In accordance with USFWS rules, EOG may on a case-by-case basis apply for exceptions, waivers, or modifications to timing limitations.
- When siting facilities, EOG would use the results of annual raptor nest surveys and other available data to avoid impacts to active nests.
- When staking a well pad, EOG would use a biological monitor to ensure no line-of-site impacts to any active nests that may have been built after the annual survey.
- EOG would install bird-excluding devices that prevent the perching and entry of migratory birds on or into new fired vessel exhaust stacks in nesting habitat of high-priority bird species.
- EOG would use closed-loop drilling systems. All produced water would be contained in closed, above-ground tanks.
- EOG would implement standards to minimize impacts to birds and other wildlife from its operations including keeping open top containers free of liquids harmful to wildlife, promptly cleaning up liquids harmful to wildlife, and routinely inspecting open-top containers.
- EOG would conduct annual inspections of avian protection measures for vessels, containers, tanks, etc. during SPCC inspections of well sites. Any deficiencies would be documented and repaired as soon as possible. Lease operators would be advised to continually monitor locations for maintenance issues including avian protection measures.
- Exhaust stacks greater than 2 inches in diameter on fired vessels (e.g., line heaters and heater-treaters) and vent stacks on non-fired vessels would be fitted with bird-exclusion devices. Active compressor engine exhaust stacks are not required to have exclusion devices; however, if a compressor is scheduled to be shut down for an extended period of time, an exclusion device would be installed.

- EOG would ensure that other openings on vessels are equipped with screens or other appropriate equipment to prevent entry by wildlife, including migratory birds.
- EOG would keep equipment with burners closed during maintenance activities and during non-operational times.
- Netting, screens, or other avian-exclusion devices would be installed on all open-top oil, condensate, and produced-water tanks, and any other open-top container that may contain liquids harmful to wildlife. Netting or screens would be inspected periodically for rips, tears, or evidence of contact with tank contents, especially after heavy precipitation events.
- Covers, wire mesh, or other material would be placed on small containers (55 gallons or less) that are left open while in use under valves or spigots to catch drips.
- Open-top tanks that do not contain harmful substance (e.g., stock water tire tanks) would be equipped with escape ramps to minimize the potential drowning of migratory birds.
- All secondary containment for chemical storage would have exclusionary devices or would be inspected routinely and, if standing fluid is found, it would be removed promptly.
- EOG would install bird-excluding devices that prevent the perching and entry of migratory birds on or into its new fired vessel exhaust stacks in nesting habitat of high-priority bird species.

Livestock Grazing

- EOG would install cattle guards at all fence crossings (unless requested otherwise by the surface owner).

Pipeline Construction

- EOG would utilize BLM Hydraulic Considerations for Pipeline Crossings of Stream Channels where feasible and authorized.

Water

- EOG would re-use drilling mud for new wells to the maximum possible extent.
- EOG would incorporate site-specific BMPs to control storm water runoff, including appropriate measures to prevent sedimentation.

- All construction and maintenance activities would cease if soils or road surfaces become saturated to the extent that construction equipment is unable to stay within the disturbance corridor, or USFS SUA or SUP, or WY TUP, and before activities cause irreparable harm to roads, soils, or excessive siltation of nearby lakes, reservoirs, or live flowing streams.

Transportation

- EOG would develop 10 new water source wells and ponds within the Project Area to provide water for drilling, completions, and dust suppression. New water wells would reduce the need to truck water, thereby reducing traffic to, from, and within the Project Area.

Safety

- EOG would restrict public access to facilities that may endanger the public. In consultation with the surface owner or AO, EOG would install "warning" signs at locations where public access could result in potential safety issues.

In addition to these ACEPMs, EOG has invested a considerable amount of time and funding into baseline environmental studies for wildlife and cultural resources in the Greater Crossbow Project Area. Information from these studies will be used to inform the eventual EIS, and will be valuable in determining the best locations for the ODPs and appropriate site-specific mitigation measures. Additional information on these studies is provided in the following sections.

Ferruginous Hawk Study

In a collaborative study with the BLM and Wyoming Game and Fish Department (WGFD), EOG has funded Hayden-Wing Associates, LLC (HWA) of Laramie, WY, to assist in a study that is collecting information on movement patterns, territory characteristics, and habitat use by ferruginous hawks (*Buteo regalis*). Although the main purpose is to collect information to better inform planning and decision making for the Project Area, the information will also contribute to a broader understanding of ferruginous hawk breeding ecology in Wyoming. EOG requested that

HWA collect the information requested by the BLM-BFO, which entails trapping and placing GPS transmitters on breeding ferruginous hawks. In 2014, HWA collared and tracked four ferruginous hawks. The study was expanded in 2015 to collar and track a total of six hawks.

In addition, HWA has been will collaborating with a separate ongoing research project being conducted by Dr. John Squires (Rocky Mountain Research Station [RMRS]) and Robert Oakleaf (recently retired from WGFD). Essentially, the planned fieldwork and trapping/tagging efforts was consolidated between the two projects in 2014, using a common study area, to avoid overlapping efforts and unnecessary disturbance to nesting ferruginous hawks. The results of the study will be used to help inform the EIS for the Greater Crossbow Project.

Cultural Resource Surveys

EOG has funded SWCA Environmental Consultants to complete a Project Area-wide Class I literature review and report. In addition, upon surface owner approval, SWCA is conducting Class III surveys on 80-acre parcels surrounding the proposed ODPs and a 500-foot-wide survey buffer along Primary Corridor locations. The block-type surveys will provide substantial data on cultural resources within the Project Area and will be beneficial in assisting with re-locating proposed locations to avoid eligible sites or artifacts.

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